cross-connect 14 or an optical add/drop multiplexer (OADM) 18.

[0040] An OADM 18 may include an all-optical cross-connect with a set of add and drop ports connected to other network elements, and may perform conversion, or adaptation of data conveyed to other networks. OADMs 18, like all-optical cross-connects 14, may overlay an electrical cross-connect adapted to regenerate signals conveyed therethrough, and so the OADM 18 or the all-optical cross-connect 14 may be used to route one or more channels through an electrical cross-connect, for example, to regenerate the signal, if the OADM 18 or the all-optical cross-connect 14 has an available drop port and an add port connected to the legacy cross-connect with which it is associated. A regenerator 20 is an OEO conversion device that does not perform cross-connect functions. Terminals are devices adapted to perform OE conversion, signal processing, and EO conversion, so they can perform electrical cross connection and traffic grooming. Terminals are therefore also adapted to serve as regenerators and recolorers. A recoloring device 22 is an all-optical device that changes the color, or wavelength of a received channel, without affecting the data content of the channel.

[0041] FIG. 2 illustrates principal modules (50, 52, 54, 55, 56) involved in controlling an agile optical network in accordance with the invention. The modules are computer functions that may be centralized or distributed among any number of processors. The functions may be performed by on-board processors that monitor transmission equipment, or processors that are independent of the transmission equipment. The modules are arranged according to a

hierarchy in which the upper modules are furthest removed from the physical layer of the network, and the lower modules are more intimately associated with the physical layer.

[0042] A service management module 50 receives requests for data transport services, as shown at 50a. As is known in the art, numerous other functions are performed by this module, including admission control signaling with edge network elements. The service management module 50 is adapted to communicate with a capacity manager module 52. The capacity manager module 52 is chiefly adapted to receive requests for capacity, access a channel capacity data store 51 to determine if capacity exists on one or more established communications channel(s) 52a to satisfy the data transport service request, and formulates a reply to the capacity request. If the capacity is not available on an established communications channel, the capacity manager module 52 issues a capacity request 52b to a wavelength and route manager (WRM) module 54.

[0043] The WRM module 54 is adapted to select at least one wavelength to provide a communications channel between the requested network elements, as shown at 54a. Resource availability data (obtained from a resource availability data store 53) and rules abstracted from signal propagation constraints are used to ensure that the selected wavelength(s) is/are likely to be viable. After the at least one wavelength is selected, the communications channel is verified, as shown at 55a, by a constraint-based routing validator (C-BRV) module 55 to ensure that the resources required for the communications channel are

available; and that the selected wavelength(s) forms a viable signal path.

[0044] The verification of viability of a communications channel over selected wavelengths requires direct access to status information that is retrieved from network elements 58, and transmission equipment 60 in a route selected for the communications channel. A photonic control plane 56 is adapted to store properties of transmission equipment, (such as fiber type of optical fiber links, number and type of amplifiers in a link, total and per wavelength signal power, optical signal to noise ratio, absorption through an all-optical cross-connect, dispersion, etc), and, by means of polling, and/or periodic reporting, the photonic control plane 56 also reports variable properties of network elements 58 and transmission equipment 60. The photonic control plane 56 is further adapted to interface with controllers of transmission equipment to obtain current status information, as shown at 56a.

[0045] Illustrated in FIG. 2 is a small subset of transmission equipment (TE) 60 in single link 10 terminated by two network elements 58 in a WDM optical network. Since transmission equipment 60 is continually autodetecting wavelength utilization and monitoring numerous other status parameters, the most accurate information regarding resource utilization and channel viability can only be obtained at the equipment control level. In accordance with the invention, this information is accessed in order to reliably determine the resource availability for, and viability of, communications channels.